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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/603,132	06/23/2000	Brian A. Vaartstra	150.00650102	3538

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EXAMINER

LEE, EUGENE

ART UNIT PAPER NUMBER

2815

DATE MAILED: 01/10/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	09/603,132	VAARTSTRA ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	Eugene Lee	2815	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 26 October 2005.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 45-74 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 45-74 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date: _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                    | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date: _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 45 thru 48, and 54 thru 59 are rejected under 35 U.S.C. 102(e) as being anticipated by Komatsu 5,907,789. Komatsu discloses (see, for example, FIG. 7C) a semiconductor device comprising a silicon semiconductor substrate (substrate assembly) 70, and metal silicide layer (diffusion barrier layer) 120. In column 22, lines 29-44, Komatsu discloses the metal silicide layer may be made of ruthenium. Komatsu also discloses that various methods can be used to form the metal silicide such as physical vapor-phase growth method or chemical vapor-phase growth method.

Regarding claims 46, and 47, see, for example, column 5, lines 56-65, wherein Komatsu discloses that x may be 2.

Regarding claim 48, see, for example, column TiN layer (one or more additional conductive layers) 114.

Regarding claim 54, see, for example, FIG. 7C wherein Komatsu discloses a MOSFET (active device) 105 and metallization material (interconnect) 118.

Regarding claim 56, see, for example, FIG. 7C wherein Komatsu discloses a TiN layer (conductive contact material) 114.

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 45, 46, 50, 51, 57 thru 59, and 63 thru 65 are rejected under 35 U.S.C. 102(e) as being anticipated by Kuroiwa et al. 6,239,460 B1 in view of Agostinelli et al. 5,017,551.

Kuroiwa discloses (see, for example, FIG. 10) a capacitor structure comprising a metal electrode (first electrode) 130/132, capacitor dielectric 115 and upper electrode (second electrode) 116. In column 13, lines 11-15, Kuroiwa discloses the ruthenium silicide layer 132 is formed from a portion of metal electrode 130. Kuroiwa does not disclose at least one of the first and second electrode comprising a chemical vapor diffusion barrier layer. However, Agostinelli discloses (see, for example, column 4, lines 22-33) a metal silicide layer made of ruthenium. Komatsu also discloses (see, for example, column 20, lines 11-16) that various, convenient methods can be used to form the metal silicide such as chemical vapor deposition procedures. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to have at least one of the first and second electrode comprising a chemical vapor diffusion barrier layer in order to conveniently form a electrode with adequate conductive properties.

Regarding claims 58, 59, 64, and 65, Kuroiwa discloses the ruthenium silicide layer (conformal layer) 132 within an opening of the insulating film 110. The aspect ratio (ratio of height to width) is clearly greater than 1.

Regarding claim 63, Kuroiwa discloses (see, for example, FIG. 10) a capacitor comprising a metal electrode (first electrode) 130, capacitor dielectric film (high dielectric material) 115, upper electrode (second electrode) 116, and ruthenium silicide layer (diffusion barrier layer) 132.

5. Claims 48, 49, 54, 55, and 69 thru 74 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kuroiwa et al. '460 B1 in view of Agostinelli et al. '551 as applied to claims 45, 46, 50, 51, 57-59, and 63-65 above, and further in view of Lee et al. 5,872,041. Kuroiwa in view of Agostinelli does not disclose a silicon containing region. However, it was well known in the art to use a substrate made of silicon (silicon containing region). Lee discloses (see, for example, column 2, lines 23-29) a semiconductor device on a silicon substrate 300. It would have been obvious to one of ordinary skill in the art at the time of invention to use a silicon containing region in order to form a semiconductor device and have diffused regions formed therein since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

Regarding claims 48 and 49, Kuroiwa discloses (see, for example, FIG. 10) a metal electrode (one or more additional conductive layers) 130 and column 9, lines 39-42 wherein Kuroiwa discloses the metal electrode comprising ruthenium (Ru) or iridium (Ir).

Regarding claim 54, Kuroiwa discloses (see, for example, FIG. 10) a DRAM (integrated circuit structure) comprising a substrate assembly including a substrate (silicon containing region) 101, transfer gate transistor (active device) 103b, and a plug (interconnect) 111 including a ruthenium silicide layer 132.

Regarding claim 69, Lee discloses (see, for example, column 2, lines 23-29) the substrate may be germanium or gallium-arsenide.

6. Claims 52, and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kuroiwa et al. '460 B1 in view of Agostinelli et al. '551 in view of Lee et al. '041 as applied to claims 48, 49, 54, 55, and 69-74 above, and further in view of Matsubara et al. 5,122,923. Kuroiwa in view of Agostinelli in view of Lee does not disclose the first electrode comprising one or more additional conductive layers. However, it was well known in the art at the time of invention to use multiple layers in the electrodes of a capacitor. In column 4, lines 25-27, Matsubara discloses a lower electrode comprising multiple layers of ruthenium, ruthenium oxide, ruthenium silicide and stacked structures consisting of these materials. It would have been obvious to one of ordinary skill in the art at the time of invention to have the first electrode comprising one or more additional conductive layers in order to form an adequate bottom electrode, and since it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art. *St. Regis paper Co. vs. Bemis Co.*, 193 USPQ 8.

7. Claims 60 thru 62, and 66 thru 68 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kuroiwa et al. '460 B1 in view of Agostinelli et al. '551 as applied to claims

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45, 46, 50, 51, 57-59, and 63-65 above, and further in view of Lee 5,897,350. Kuroiwa in view of Agostinelli does not disclose the opening having an aspect ratio greater than about 3.

However, Lee '350 discloses (see, for example, FIG. 4B) a semiconductor device comprising a contact hole (opening) 32 having an aspect ratio greater than 3. It would have been obvious to one of ordinary skill in the art at the time of invention to have the opening have an aspect ratio greater than about 3 in order to provide higher integration in a semiconductor device since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

### *Response to Arguments*

8. Applicant's arguments with respect to claims 45-74 have been considered but are moot in view of the new ground(s) of rejection.

Regarding applicant's argument on page 11, first paragraph of the amendment filed 10/26/05 that Komatsu fails to provide an enabling disclosure of a chemical vapor codeposited diffusion barrier layer formed of  $\text{RuSi}_x$ , this argument is not persuasive. In column 22, lines 29-39, Komatsu clearly discloses that the metal silicide layer may be made of silicon and one of many metals including ruthenium. Because Komatsu states in the same paragraph the possible precursors for Ti, W, Mo, Ta, Pt, Re does not preclude the fact that Komatsu specifically states in the same paragraph that the metal silicide layer may comprise one of many metals including ruthenium.

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### INFORMATION ON HOW TO CONTACT THE USPTO

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eugene Lee whose telephone number is 571-272-1733. The examiner can normally be reached on M-F 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kenneth Parker can be reached on 571-272-2298. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Eugene Lee  
January 6, 2006

A handwritten signature in black ink, appearing to be 'E. Lee', written in a cursive style.